

7.  $f(x) = \sqrt{x+1}$  at  $x=3$

$$\frac{d}{dx}(\sqrt{x+1}) \big|_{x=3} = \frac{1}{4}$$

use  $\lim_{x \rightarrow 3} \frac{(\sqrt{x+1} - \sqrt{3+1})(\sqrt{x+1} + \sqrt{3+1})}{(x-3)(\sqrt{x+1} + \sqrt{3+1})}$

$$\lim_{x \rightarrow 3} \frac{x+1-4}{(x-3)(\sqrt{x+1} + \sqrt{3+1})} = \frac{1}{4}$$

$y = \sqrt{x+1}$

Graph showing points  $P(3, 2)$  and  $Q(3+h, \sqrt{3+h+1})$  on the curve. The secant line is labeled  $(x, \sqrt{x+1})$  and the horizontal distance is  $x=3+h$ .

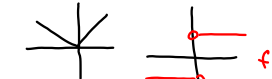
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## 3.2 Differentiability

A function will not have a derivative at a point  $(a, f(a))$  if the slopes of the secant lines fail to approach a limit as  $x$  approaches  $a$

Use differentiability.tns to investigate several functions.

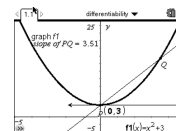
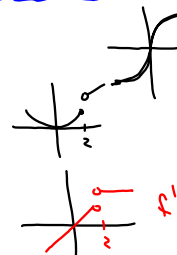
corner:



cusp

vertical tangent

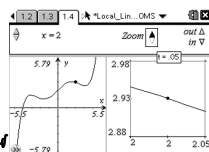
discontinuity



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## Local Linearity

A good way to think of differentiable functions is that they are locally linear. Experiment with Local Linearity.tns and then write a definition of "locally linear"



not vertical

not locally linear

is locally linear, but it's vertical (no slope)

Differentiability implies continuity.  
(but not the converse)

If  $f(x)$  is differentiable  
then  $f(x)$  is continuous

converse

If  $f(x)$  is continuous  
then  $f(x)$  is differentiable T/F

counterexample ✓

Sep 10-1:59 PM

Sep 10-2:14 PM

Sep 10-2:04 PM